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FOREIGN DOCUMENTS OR RADIO BROADCASTS

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THIS IS UNEVALUATED INFORMATION

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INFORMATION FROM THE BOOK "DESULFURIZATION OF COKE GAS AND OTHER COMBUSTIBLE GASES" BY N. N. YEGOROV, M. M. DMITRIYEV, D. D. ZYKOV

The treatment of combustible gases and gaseous fuels is of considerable industrial, military, and economic importance because (a) gases treated by the methods described are used in synthesis and thus converted into other products, for instance, liquid fuels; and (b) efforts are being made in the USSR to replace solid and liquid fuels with gas and, in connection with this, to introduce efficient methods of flameless surface combustion.

The commentary, preface, selected excerpts, two tables and the complete table of contents of subject book are given below.

Russian Editorial Commentary

This book gives a review of methods of purification of combustible gases from hydrogen sulfide and organic sulfur compounds. In the case of methods which are of the greatest practical importance for industry, a description and calculation of basic equipment is given and the production coefficients are cited. Furthermore, conditions for the purification of the gas prior to desulfurization are described, as well as methods for the utilization of hydrogen sulfide gas obtained in cyclic purification procedures. The most important desulfurization processes are evaluated and compared.

The book supplies information needed by engineers and technical workers of the coke-chemical and gas industries. It may also be of use to students who specialize in the conversion of fuel and combustible gases.

Preface

The law on the Fourth Five-Year Plan [1946 - 1951] has set the task of increasing the utilization of gaseous fuel for industrial and household purposes. To accomplish this task effectively, it is necessary to apply the most efficient and economical procedures for removing hydrogen sulfide and organic sulfur compounds from gases utilized in this manner.

The present work illustrates the contemporary status of questions connected with desulfurization and describes the most important methods of purification.

The existing literature on these questions is out of date, incomplete, or lacks a critical evaluation and comparison, so that the present book supplies an essential need.

Excerpts From Various Chapters

Coal from the Donets Basin contains 5-6% S; that from the Kuznetsk Basin usually no more than 0.5% S; and Karaganda coal about 1% S. Desulfurization of coke gas is therefore of the greatest importance when Donets coal serves as crude material [p 8].

* * *

The arsenic-soda method of purification from hydrogen sulfide was developed in the USSR in 1930 - 1932 at UNIKhIM (Ural Scientific Research Chemical Institute), Sverdlovsk. It was studied in detail at UKhIN (Scientific Research Institute of Coal Chemistry), Khar'kov, and by the Gazoochistka Trust (Gas Purification). This method is being applied extensively in the USSR industry at present. The modified process developed in the USSR represents a simplification as compared with the method described in US publications. This is shown by reaction schemes given in the text [pp 51-53].

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The so-called cyclic processes involve absorption of hydrogen sulfide by a liquid sorbent, removal of hydrogen sulfide from the sorbent in a distillation column, and recirculation of the sorbent to absorb more hydrogen sulfide. Installations of this type were introduced in the 1930's and have been applied on an extensive scale in recent years. In the USSR a considerable amount of work on the introduction of this type of processes was done by M. S. Litvinenko and M. V. Gofttman (UKhIN), who used carbonate solutions for the removal of hydrogen sulfide from coke gas. Application of cyclic methods for the purification of other industrial gases was investigated by S. M. Golyand at NIOGAZ (Scientific Research Institute of Industrial and Sanitary Gas Purification) and Leybush at GIAP (State Institute of Nitrogen Industry). Development work on the earliest projects involving application of cyclic processes was carried out by the Gazoochistka Trust. Purification under application of ethanolamines was investigated by A. P. Andrianov and S. M. Golyand.

As far as evolution of absorbed hydrogen sulfide on heating is concerned, the most advantageous properties among chemical solvents are exhibited by ethanolamine solutions and salts of amino acids (alkazid) [pp 94-103].

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For the conversion of hydrogen sulfide to sulfur, a catalyst of the type used at copper-sulfur plants may be utilized to advantage. According to tests carried out at NIOGAZ this catalyst is distinguished by a high and constant activity. The catalyst is prepared by mixing aluminum cement, aluminum hydroxide, aluminum powder, a calcium hydroxide suspension, and water. The resulting mass is then poured into molds and allowed to solidify. On solidification the mass is ground. The catalyst has the following composition: 7.36% SiO_2, 46.89% Al_2O_3, 5.81% Fe_2O_3, 38.07% CaO.

Certain grades of bauxite are also satisfactory for use as a catalyst in this conversion /pp 222-223/.

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For various reasons, some of the methods described in the book are unsuitable for practical application at this stage. This applies to all methods combining several processes and to all oxidation methods with the exception of the one utilizing arsenic. One must also exclude older methods which have been used in the industry, but are relatively inefficient from the technological and economic standpoints. Thus, wet iron-alkali methods are less advantageous than the arsenic-alkali process because the latter yields purer sulfur. The ethanolamine cyclic process is preferable to the phenolate cyclic process, because the ethanolamine method, with the same initial outlay and costs for maintenance, yields a purer gas and is applicable in the presence of CO_2 and even of some oxygen. For all practical purposes, purification with ethanolamine has already replaced the phenolate method.

The cyclic tri-potassium phosphate and alkazid methods have specialized applications only. Tri-potassium phosphate is used when purification must be carried out at a high temperature (up to 90°). The only advantage of the alkazid method, which is widely used in Germany, is selective absorption of hydrogen sulfide in the presence of large quantities of carbon dioxide, but the ethanolamine method (under application of triethanolamine) shows the same selectivity (data of the Gazoochistka Trust).

There are only individual installations using the ammonia and iron cyanide methods. In view of the lack of experience with these installations, an evaluation of the methods in question must be delayed.

The methods which are of importance from the point of view of extensive application in industry are: (1) desulfurization with iron hydroxide (dry method); (2) desulfurization with activated carbon (dry method); (3) arsenic-alkali method (wet); (4) treatment with ethanolamine (wet); (5) vacuum-potash method (wet); and (6) vacuum-soda method (wet). Methods 1 and 2 are suitable when the hydrogen sulfide content is low, with 2 preferable in large installations. As distinguished from 3, processes 4, 5, and 6 are cyclic, and therefore of greater economic advantage. However, 3 yields elemental sulfur, which is a commercial product, while 4, 5, and 6 result in hydrogen sulfide. If the desired end product is sulfuric acid, the cyclic processes yielding hydrogen sulfide are preferable to 3. In Method 3 a lot of power and comparatively small amount of steam and water are used; in 4, 5, and 6, on the other hand, much steam and water and a relatively small amount of electric power are used. As far as the degree of purification is concerned, 4 is the most efficient method. Unless the gas pressure is elevated, 4 is followed by 3 and 5 or 6, in that order. Among the cyclic methods, 4 has every advantage. However, one must also consider the composition of the gas in selecting the method /pp 233-238/.

Table 7 /p 11/. Composition of Natural (Oil Field) Gases and Their Hydrogen Sulfide Content in Volume Percent

Origin of Gas	H_2S	N_2	CO_2	CH_4	C_2H_6	C_3H_8	C_4H_{10}	C_5H_{12}
Kuybyshev gas (Kalinovka)	1.0	14.5	0.2	76.7	4.5	1.7	0.8	0.6
Ishimbay	3.0-4.6	1-7	1.4-1.6	39-57	2.8-11.7	13-16	10-11	8-11
Kinel'neft' /Kinel' Petroleum/	2.0	10.0	0.8	71.7	7.0	4.0	3.0	1.5

Table 41 /pp 236-237/. Orientation Data on the Applicability of Various Methods for the Desulfurization of Gases

Type of Gas	Hydrogen Sulfide Content (gr per nm^3 /normal cu m?/)	Method of Purification When Gas Is To Be Used for				
		Heating of Boilers	Metallurgical Furnaces	Synthesis and Conversion	Conveying Over Long Distances	For Household Needs
Coke gas from						
Southern plants	18-22	-	Arsenic or potash	Arsenic or potash + dry method (iron hydroxide)		
Eastern plants which use Kuznetsk coal	3-4	-		Dry method (iron hydroxide)		
Eastern plants which use Kizelevsk coal	35-40	-	Arsenic	Arsenic or potash + dry method (iron hydroxide)		
Low-temperature coking	20-40	Arsenic or potash	Arsenic	Arsenic or potash + dry method (iron hydroxide)		
Low-temperature coking of combustible shales	6-8	-	-	-	Dry method (iron hydroxide or activated carbon)	
Hydrogen installations	4-20	-	-	Ethanolamine	-	-
Water gas	4-6	-	-	Ethanolamine	-	-
Generator gas (produced by steam and air blowing) from						
Anthracite	3-4	-	-	Dry method (iron hydroxide or activated carbon)		

Table 41. (Contd)

Type of Gas	Hydrogen Sulfide Content (gr per nm3 /normal cu m?/)	Method of Purification When Gas Is To Be Used for: Heating of Boilers	Metallurgical Furnaces	Synthesis and Conversion	Conveying Over Long Distances	For Household Needs
Coal from Moscow Basin	20	Arsenic or potash	-	Arsenic or potash + dry method (iron hydroxide)		
Subterranean gasification	20	Arsenic or potash	-	-	Arsenic or potash + dry method (iron hydroxide or activated carbon)	
Natural gas from oil fields	25-90	Ethanolamine, arsenic, or potash	-	Ethanol amine	Ethanolamine + drying	Ethanolamine
Gas from petroleum conversion	30-150	Ethanolamine, arsenic, or potash	-	Ethanolamine or tri-potassium phosphate, when temperature of gas is high	Ethanolamine	Ethanolamine

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